Fab labs as catalysts for sharing economies in Latin America

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Abstract

Sharing economic models have been the center of much attention and criticism in recent years. Their cooptation by the so-called "death star platforms" have put the concept under fire and have raised the question of whether these so-called "collaborative" models can live up to the expectations in terms of creating sustainable models that can create impact in their contexts. The present paper explores the development of platform-based cooperation within the fab lab network of Latin America and how can these concepts a catalyst for social-based innovation, taking into account their strengths and weaknesses. A dataset of edit history of files in the official repositories of three international collaborative projects created and maintained by users of the FABLAT network on Google Drive was mined and analyzed in an exploratory manner in order to gain a clear idea of how volunteer-international based collaboration between fab labs works at a distance and how it can be improved.

Introduction

Within a decade, the fab lab movement has grown from an enthusiastic project with international projection into a massive network of 1167 laboratories in 106 countries. Across these diverse and thriving communities of makers, Latin America has come to be known for being one of the most engaging in terms of collaboration for their projects, in part due to the longevity of many of their fab labs in relation to others in the world, but also explained by the level of engagement of makers in the region. It began with a fairly small community that started informally at the FAB7 Conference[1] at Lima, Perú, with the intention of generating a space of inclusion for members of Latin American fab labs. After six years it has grown into a larger community which includes members from most countries in the region.

Although online peer production models have been well established through software development models such as the open source communities for projects such as Wikipedia or Linux, the most well-known projects among many, the transition of these bazaar-style models of collaboration into the realm of physical is still young in terms of engagement and scope due to the constraints that these models pose in terms of diffusion models (physical vs virtual), licensing, and accountability (who does what designed by whom) in this regard, we need to take into account the different stages of collaboration (Rottman et al, 2011):

- *Contributory Projects*, in which the users just funnel information into the organizers or researchers
- *Collaborative Projects*, in which participants collect data and can participate in the Design of the Project
- *Co-Created Projects*, in which participants and organizers work together in all aspects of the Project

We can add to this Discussion the Definition of Collaborative Economy used by the Ouishare Collective (Ouishare, 2011) which states that "Collaborative Economy is defined as practices and business models based on horizontal members and participation of a community"

Taking these aspects into perspective, it can be argued that the fab lab model has been somehow succesful to date is due to the standardization of two main aspects: The normalization of capacities and skillset through the Fab Academy courses being promoted within the community, and the standardization of physical requirements for the installation of a fab lab. The ability to exchange ideas within the boundaries of a network added up to the ability to guarantee their physical replication could be argued as one of the main strengths of the fab lab movement around the world.

One of the main characteristics of collaborative projects is the level of engagement of participants in them.

- Many, if not most of them are volunteers
- It can be argued that the engagement can be described by a power-law relationship.

Our data analysis aims to characterize the levels of engagment for certain projects in the Latin American Fab Lab Network (FABLAT) in order to discern the underlying organizational structure behind them and their possible causes.

Obtaining engagement data

Although there are little available information about the actual levels of engagement of members of the network, the fact that many of the projects within the network have thrived for sustained periods of time, in some cases over the span of years, gives the impression that a measure of good collaborative practices account for the interest that has kept volunteers into the project. One of the most critical differences between software-based projects to other types of collaborative projects is the ability to track down the amount of time or effort effected by participants in them, and thus, the ability to demonstrate said engagement. The limitations extend to the hours invested in prototyping in the fab lab machines, local management and other "overhead" activities. However, observed assiduous content generation insinuates that there are incentives related to the philosophy of openness in order for participants to continue engaged in them. (Scacchi, 2010) argues that "failure to enact and sustain such beliefs can lead to participants being challenged by others regarding their commitment to collaboratively develop FOSS in a proper manner, so the absence or failure of such an affordance can drive FOSS developers apart."

Despite the limitations to the amount of information regarding engagement, a premise for the analysis of levels of participation could be taken from similarities to online, peer-produced software initiatives, which are also mostly through volunteer initiative, using an online repository, and loosely managed by creators. In the case of the FABLAT Network, a very fitting source of information comes from the use of Google Drive folders, due to the sustained use of Google products as a platform for communications and contribution from all of their members.

Contrary to platforms that have been designed to measure interaction and contributions, such as GitHub, Google Drive does not natively provide with statistics in order to analyze data in depth as part of the services offered to casual users through its platform. However, the Google Drive API can be used to gain access to the modification history of the files in the platform, given some limitations such as the following:

- Data can only be mined from files to which complete access to the files in question has been granted. This proves to be difficult since and it also raises questions regarding the openness of the use of the platform.

- The level of engagement is measured by modifications to files, which could be valid in some cases but not in all, for example, in cases where said modifications are made outside of the platform, i. e. generation of files such as graphic design or 3D models outside of the Google Drive platform, case in which the amount of time or effort invested cannot be accurately measured.
- Forking cannot be consistently measured within the mechanics of the platform being used.

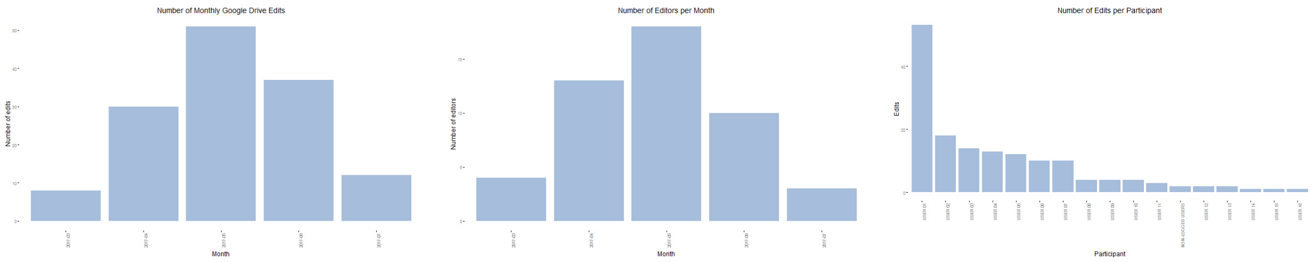
Three projects on which a considerably large number of persons have participated consistently and to which access and permission to mine data was granted by administrators were chosen for this study, said data was obtained and analyzed by using scripts written in Python and R.[2]

The projects analyzed were: the Fab13 Latin American pavilion design, FABLAT Kids, and Floating Fab Lab Amazon, due to the amount of participants, and the notoriety of said projects within the regional network.

Participation analysis

Datasets for each project were processed to measure the following:

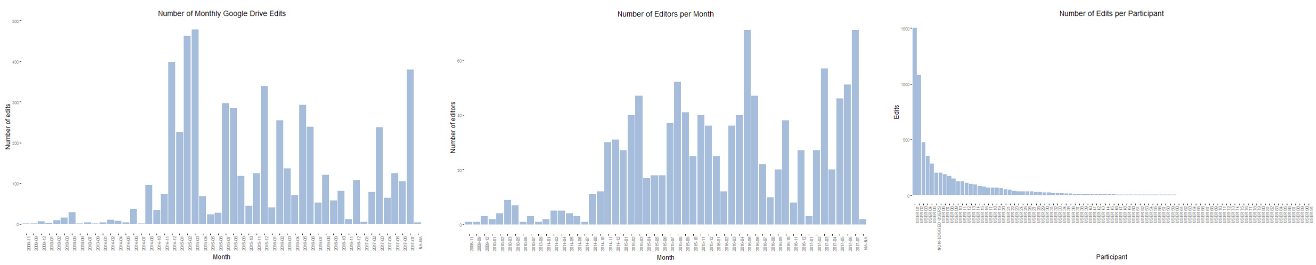
1. Level of commitment of participants, shown by the number of modifications made to files, and the distribution of said measurement against the community.
2. Level of engagement over the timeline of the project: the community dynamics throughout the development of the project can be shown by measuring how much the community participated during the life cycle of the project.
3. Rate of participation of collaborators: we compared modifications for each file against number of involved editors, and shared collaboration among editors, by analyzing how many participants worked together on the same files.



Fab13 FabLAT Pavillion

PaperFLF

Floating Fab Lab Amazon



FABLAT Kids

Some of the observed appreciations are:

- Although a visual correlation can be established, there doesn't seem to be a direct relation between number of editors and the amount of work done in the FLF Project. Maximum values on the amount of

edits does not amount to the maximum amount of participants involved, which raises a question on the levels of engagement towards the project. It would seem to be that new editors have a limited participation and disengage from the community shortly after starting.
- The time frame of activities in the Projects also needs to be taken into account, regarding this, we can see that the highest level of participants regarding the FLF Project follow diffusion activities and workshops, after which the activity level and participants engaged diminished in a significant manner.
- FLF changed from being a contributory project on which a few experts took the lead on what should be studied and where other participants worked on those subjects, to a more collaborative one where new initiatives would arise, led by the community and supported by smaller groups. This produces a tradeoff in terms of the scope and skillset and effectiveness in the generation of results. We would need, however, further analysis to confirm this assumption.

- The distribution of editors and their edits seems to approximate to a power-law distribution. For example, 4 participants of the Amazon Floating Fab Lab add up to over 50% of the edits, and 10 of them share around 75% of edits. Also, data shows a perfect Pareto proportion (80/20), with the 13th user (20.6%) making up for 80% of the cumulative number of edits in the history of the project. This may lead to believe that the contributors to this project form a more hierarchical structure.
- Files where most editors were engaged were also the ones with a highest rate of edits per editor, which would seem to be due to a 'rich-get-richer' phenomenon.

- The Fab Lab Kids Project shows and even more unequal distribution, with the first 13 users (including non-logged users) making 80% of the total edits, out of a user base of 91, which accounts up to 14.28% of the participants, this suggests an even more stark hierarchy.
- However, the most striking difference came regarding the time frame of the Project. Since the nature of the FabKids Project is about designing activities and putting them in practice, thus generating continuous diffusion via workshops, classes and informal instruction, a more stable frequency of activity (document edits and participants) can be seen, it can be argued that this is due to this particular characteristic.
- Regarding the Fab Pavilion Project, a very hierarchical structure can also be noticed, however, the user base is too small to get into deeper analysis.

Conclusions

Although the analysis has its limitations, we believe that levels of online engagement in the development of projects are a good way to measure the level of engagement of communities, and how the composition of contributions is structured can tell us about the authorship and incentives of participants of the project. In this sense, the projects analyzed show definite hierarchical levels, with a certain group of *superusers* who are deeply engaged in the project, while a vast majority make marginal work, more likely replication of certain experiences or minor edits. The depth of these hierarchical levels is more patent in the two bigger projects, probably becoming more visible as time advances.

We can infer regarding the previous conclusion that the possible causes of these structures could be personal, in the way of personal incentives for people in the network to participate, that specialized knowledge and specific hardware requirements have become, in part, an entry barrier for certain participants in the aforementioned projects, or that few members of theh community are actually invested in the longevity. Further analyzes with statistical tools could weigh the effective contributions of the users and their development (as in deltas in project content in time) in order to establish how steep the learning curve for new participants might be needed in order to fully engage them in projects. This can also teach us about the importance of a participatory strategy for entry-level participants in order to engage them and

empower them in these types of projects. This could be done, for example, through a change in the granularity for projects.

Many of the limitations to the model used can be accounted to the use of Google Docs and its lack of modifications registry. Wikipedia model, GitHub and more specialized platforms that allow to verify and rate contributions by users. These limitations extend to the point that there is no chance to control whether derivatives (copycats, forking) are born from the original data, so any intellectual property rights could not be properly protected should this happen. Furthermore, the actual systems have a serious limitation regarding data integrity and protection, as an honor-based system, there is always the risk that due to misuse or deception, all data could be lost or corrupted, in this respect, the advantages of an SCM could become a very welcome addition.

An issue for future discussion regarding the previous two points derive from how necessary is it to establish and/or enforce a license type for project documentation. An addition of such a system to manage the projects' data could be even more beneficial for the further dissemination for the projects, as such structure would create roadmaps for newly integrated participants to join and learn and could also control the forking of content, increasing collaboration among peers and the knowledge base.

Finally, we could clearly classify Projects where very few people engage in participation can be classified as contributory projects instead of collaborative or co-created projects. Given the duration of these Projects (Fab Kids and FLF), the lessons learned regarding the information management could prove fruitful for future regional project initiatives, as to how collaborative projects in the FABLAT and Fab Lab Networks in general are intended to be, and how information, contribution and projects management can be crucial to engage new and old participants.

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1. 7th International Fab Lab Conference and Symposium↩

2. For sake of analysis reproducibility, a copy of one version of the code used, alongside the mining script can be found at http://rpubs.com/dbsnp/293565.↩